

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Cancelled).

Claim 2. (Original) A light control element comprising:

a substrate;

an optical waveguide formed on said substrate;

an optical coupling component provided on said substrate by a photonic crystal structure, said optical waveguides being connected to said optical coupling component; and
a variable refractive index part provided in a part of said photonic crystal structure, said variable refractive index part dividing said optical coupling component into at least two regions,

wherein an interface between said regions changes a traveling direction of a light incident thereto by causing reflection in at least one wavenumber of said light in response to a change of refractive index in said variable refractive index part.

Claim 3. (Original) A light control element comprising:

a substrate;

a plurality of optical waveguides formed on said substrate;

an optical coupling component formed on said substrate, at least three of said optical waveguides being coupled to said optical coupling component; and

a photonic crystal formed on at least one of said optical waveguides at an end part thereof coupled to said optical coupling component,

said light control element changing a transmittance of light through said optical waveguide in a part corresponding to said photonic crystal structure in response to a change of refractive index of said photonic crystal structure.

Claim 4. (Original) A light control element comprising:

a substrate;

a plurality of optical waveguides formed on said substrate;

an optical coupling component formed of a photonic crystal and provided on said substrate in a polygonal form, at least four of said optical waveguides being coupled to said optical coupling component; and

a plurality of variable refractive index parts formed in said polygonal optical coupling component, said plurality of variable refractive index parts being formed in one or more regions of said polygonal optical coupling component divided from each other by a diagonal line,

said plurality of variable refractive index parts changing a refractive index thereof independently,

said light control element deflecting a traveling direction of light in said optical waveguide in response to a change of refractive index of said variable refractive index part.

Claim 5. (Original) A light control element comprising:

a substrate;

a plurality of optical waveguides formed on said substrates;

an optical coupling component formed of a photonic crystal and provided on said substrate in a polygonal form, at least four of said optical waveguides being connected to said optical coupling component;

a photonic crystal formed on said optical waveguides at an end part thereof connected to said optical coupling component; and

a plurality of variable refractive index parts formed of said photonic crystal and provided on said optical waveguide in correspondence to regions of said polygonal optical coupling component divided from each other by a diagonal line,

said variable refractive index parts changing a refractive index thereof independently,

said light control element deflecting a traveling direction of light from said optical waveguide in response to a change of refractive index of said variable refractive index part.

Claim 6. (Original) A light control element comprising:

a substrate;

a plurality of optical waveguides formed on said substrate; and

an optical coupling component formed of a photonic crystal and provided on said substrate in a polygonal form, at least four of said optical waveguides being coupled to said polygonal optical coupling component; and

a plurality of variable refractive index parts formed in respective regions of said polygonal optical coupling components, said regions being divided from each other by a diagonal line of said polygonal optical coupling component,

said variable refractive index parts changing a refractive index thereof independently,

said light control element branching a light in said optical waveguide in response to a change of refractive index of said variable refractive index part.

Claim 7. (Original) A light control element comprising:

a substrate;

a plurality of optical waveguides formed on said substrate;

an optical coupling component formed on said substrate and coupled with at least three of said optical waveguides;

first and second photonic crystals formed on an optical waveguide coupled to said optical coupling component at an end part thereof coupled to said optical coupling component, said first photonic crystal including a structure for reflecting or transmitting a transverse electric mode wave, said second photonic crystal including a structure for reflecting or transmitting a transverse magnetic mode wave; and

first and second variable refractive index parts provided respectively by said first and second photonic crystals, said first variable refractive index part and said second variable refractive index part respectively changing a transmittance of said transverse electric mode wave and a transmittance of said transverse magnetic mode wave independently from each other,

said light control element separating a transverse electric mode wave and a transverse magnetic mode wave in response to a change of refractive index of said first and second variable refractive index parts.

Claim 8. (Original) A light control element, comprising:

a substrate;

a plurality of optical waveguides formed on said substrate;

an optical coupling component formed on said substrate, at least three of said optical waveguides being connected to said optical coupling element;

first and second photonic crystals formed on an optical waveguide coupled to said optical coupling component at an end part thereof coupled to said optical coupling component, said first and second photonic crystals respectively including a structure for

reflecting or transmitting an transverse electric mode wave and a structure for reflecting or transmitting a transverse magnetic mode wave; and

first and second variable refractive index parts formed respectively in said first and second photonic crystals, said first variable refractive index part and said second variable refractive index part changing a transmittance of said transverse electric mode wave and a transmittance of said transverse magnetic mode wave respectively by changing a refractive index of said first and second variable refractive index parts independently.

Claim 9. (Currently Amended) A light control element as claimed in claim [1] 2, wherein said photonic crystal includes a defect region.

Claim 10. (Original) A light control element as claimed in claim 9, wherein said photonic crystal includes at least two layers of photonic crystal arrays at both sides of said defect region, a refractive index being changed for said defect region.

Claim 11. (Original) A light control element as claimed in claim 9, wherein said photonic crystal includes at least two layers of photonic crystal arrays at both sides of said defect region, a refractive index being changed for the entirety of said photonic crystal.

Claim 12. (Original) A light control element as claimed in claim 9, wherein said photonic crystal includes at least two layers of photonic crystal arrays at both sides of said defect region, each of said photonic crystal arrays including the same number of layers.

Claim 13. (Original) A light control element as claimed in claim 12, wherein the number of layers of the photonic crystal array is ten or less.

Claim 14. (Original) A light control element as claimed in claim 9, wherein said photonic crystal has a structure having a wave vector component of a light incident to said defect region through said photonic crystal in a direction other than the direction perpendicular to the elongating direction of the defect region.

Claim 15. (Original) A light control element as claimed in claim 9, wherein the photonic crystal includes plural defect regions of different sizes.

Claim 16. (Currently Amended) A light control element comprising:
a substrate having a photonic crystal structure;
a plurality of optical waveguides formed in said photonic crystal structure in the form of a line defect of said photonic crystal structure; and
a variable refractive index part formed in an optical coupling part, said optical coupling part forming an intersection point where ~~in which~~ said optical waveguides intersect with each other,
said light control element controlling a state of resonance in said optical coupling part by changing a refractive index of said refractive index variable part.

Claim 17. (Currently Amended) A light control element comprising:
a substrate having a photonic crystal structure; a plurality of optical waveguides formed in said photonic crystal structure of said substrate in the form of a line defect of said photonic crystal structure so as to divide said photonic crystal structure into plural regions;
and

variable refractive index parts each formed in one of set to said respective ~~[[parts]]~~
regions of said photonic crystal structure defined by said optical waveguides, each of said
variable refractive index parts including a first photonic crystal part and a second photonic
crystal part divided from each other diagonally,

said light control element changing a refractive index of said ~~variable refractive index~~
~~parts~~ first and second photonic crystal parts in each of said regions independently.

Claim 18. (Currently Amended) A light control device, comprising:

a substrate;

NxN optical waveguides formed on said substrate so as to cross with each other at
intersections distributed two-dimensionally on said substrate; and

N² optical coupling components each provided to one of said intersections of said
optical waveguides,

a variable refractive index part provided to each of said optical coupling component,
each of said variable refractive index ~~part~~ parts ~~forming a light control element of any~~
~~of the first through fourteenth aspect of the present invention~~ dividing said optical coupling
component into at least two regions,

wherein an interface between said regions changes a traveling direction of a light
incident thereto by causing reflection in at least one wavenumber of said light in
response to a change of refractive index in said variable refractive index part.

Claim 19. (Currently Amended) A light control device comprising:

a substrate having a photonic crystal structure;

NxNxN optical waveguides formed in said photonic crystal structure of said substrate so as to cross with each other at intersections distributed two dimensionally on said substrate and

an optical coupling part formed in each of said intersections, said optical coupling part forming an intersection point where said optical waveguides intersect with reach other,

each of said optical coupling ~~part including a photonic crystal parts~~ forming a variable refractive index part,

said light control device controlling a state of resonance in said optical coupling parts by changing a refractive index therein independently.